

PROJECT FACT SHEET

CONTRACT TITLE: Increasing Waterflood Reserves in the Wilmington Field through Improved Reservoir Characterization and Reservoir Management -- Class III

ID NUMBER: DE-FC22-95BC14934

B&R CODE: AC1010000

CONTRACTOR: City of Long Beach
Dept of Oil Properties

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PROJECT SITE

CITY: Long Beach **STATE:** CA
CITY: Wilmington Field, Los Angeles Co. **STATE:** CA
CITY: **STATE:**

CONTRACT PERFORMANCE PERIOD:
3/21/1995 to 12/1/2001

PROGRAM: Reservoir Life Extension
RESEARCH AREA: Class 3
PRODUCT LINE: ADIS

CO-PARTICIPANTS:

PERFORMER: Tidelands Oil Production Co
PERFORMER: Stanford Univ
PERFORMER: Magnetic Pulse
PERFORMER:

CITY: Long Beach **STATE:** CA **CD:**
CITY: Stanford **STATE:** CA **CD:**
CITY: Houston **STATE:** TX **CD:**
CITY: **STATE:** **CD:**

FUNDING (1000'S)	DOE	CONTRACTOR	TOTAL
PRIOR FISCAL YRS	1812	2181	3993
FY 2002 CURRENT OBLIGATIONS	0	0	0
FUTURE FUNDS	0	0	0
TOTAL EST'D FUNDS	1812	2181	3993

OBJECTIVE: The transfer of technologies, methodologies, and findings developed and applied in this project to other operators of Slope and Basin Clastic (SBC) Reservoirs. This project will study methods to identify sands with high remaining oil saturation and to recompleat existing wells using readily available advanced completion technology.

PROJECT DESCRIPTION:

Background: Often R&D benefit risk costs are too high for individual companies, but not for the oil industry as a whole. This fits the case for SBC oil reservoirs in California, which hold tens of billions of barrels of lower quality oil that is recoverable but of economically marginal value. Through improved technology this R&D project seeks to lower operating costs associated with recovery of this oil in a strict California regulatory environment. This project demonstrates application of current R&D technology, including a case history application of forward modeling and inversion processing to enhance understanding of horizontal log response and reservoir structure based on data from a horizontal well drilled onshore in California. The well was drilled in thin Miocene age turbidite sands to test economic recovery potential of remaining reserves in the 60 year old Wilmington Field, using new technology for reservoir characterization, including 3-D geologic modeling, geosteering in thin beds, and modeling the Logging While Drilling (LWD) responses. Pre-well modeling calculations were used for multiple sets of horizontal and vertical resistivity data measurements, based on differing frequencies and transmitter to receiver spacing. Results from post-well modeling were compared with actual data in the pre-well model, this allows for clear interpretation of the structure around the well bore and refinement of the geologic structure for effective placement of future wells.

Work to be Performed: The identification of sands with high remaining oil saturation will be accomplished by developing a deterministic three dimensional (3-D) geologic model. The wells identified by the geologic and reservoir engineering work as having the best potential will be logged with cased-hole logging tools. The application of the logging tools will be optimized in the lab by developing a rock-log model. This rock-log model will allow us to translate measurements through casing into effective porosity and hydrocarbon saturation. The wells that are shown to have the best oil production potential will be recompleted. Evaluating short radius lateral recompletions as well as other recompletion techniques such as the sand consolidation technique through steam injection will help optimize the recompletions. Cumulative oil production from 6 recompleted project wells and two short radius redrilled project wells is 192,394 bbls as of November 30, 2001. At this rate almost 6 million barrels of incremental oil could be produced from this project. If expanded field-wide, this technology could recover an additional 28 million barrels of oil. Knowledge expanded to southern California clastic reservoirs could produce 733 MMBO. Increasing domestic production will reduce USA dependence on foreign oil, reduce the foreign trade deficit, and reduce oil spills from import oil in tankers.

PROJECT STATUS:

Current Work: Project is in Budget Period II.

Scheduled Milestones:

Log candidate wells with cased hole logging tools	06/99
Recomplete wells	12/01
Rock-log and fluid log models	09/00
Reservoir data input and manipulated with software	09/00
Identification of by-passed oil	12/01
Deterministic 3-D geologic model	12/01

Accomplishments: The most recent accomplishment was the drilling of a new horizontal well into a relatively thin sand and successfully gravel packing a wire wrapped screen in place. Previous accomplishments included: developed rock-log and fluid-log models needed to interpret the acoustic log data. Continuing to update and refine these models. Have input production and injection data for Fault Blocks IV & V. Various reservoirs and areas within these fault blocks have been examined with reservoir management software. Logged eight (8) wells with acoustic logging tools. Located a significant new reservoir dubbed the 'Hxo' sand reservoir with the geologic 3-D model. Recompleted six (6) idle wells; three (3) wells with 'optimized' waterflood techniques and three (3) wells completed and on production with the novel steam consolidation technique. Redrilled one (1) idle well with horizontal technology and drilled one (1) new well with similar horizontal technology. Researchers were able to use a pulling rig to complete the operation on the former well. Created highly accurate 3-D visualizations of the Upper Terminal Zone Fault Block 5 'Hxo' reservoir and the Tar Zone Fault Block 5 'Fo' reservoir. The 3-D models helped isolate the data inconsistencies while the 3-D viewers were good for adding data to correct the geologic model. A paper was written for the Gulf Coast Section of the Society of Economic Paleontologists and Mineralogists (GCSSEPM) Foundation 20th Annual Research Conference Deep-Water Reservoirs of the World, December 3-6, 2000. Presentations were made to local and national organizations: Society of Petroleum Engineers (SPE), American Association of Petroleum Geologists (AAPG), American Geophysical Union (AGU), Society of Professional Well Log Analysts (SPWLA), Society of Exploration Geophysicists (SEG), Petroleum Technology Transfer Council (PTTC), Stanford Rock and Borehole Physics Consortium (SRB). As of November 30th, 2001, project cumulative oil production stands at 192,394 bbls of oil from six (6) recompleted wells one (1) redrilled well, and one (1) new well.

TECHNOLOGY TRANSFER:**Technology/Information Transfer:**

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